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- Fig. 14. Normal plasmodium as found in early stages of the disease, $\times 600$.
 15. Aggregated appearance of plasmodium $\times 300$.
 16. Section showing another aggregated appearance in which the spherical masses are much smaller, $\times 200$.

FIELD NOTES, 1891.

By ERWIN F. SMITH.

It can scarcely be doubted that climatic conditions exert a marked influence on the spread of many fungus diseases. Bad weather may render the host more susceptible, or only afford the parasite increased facilities for multiplication, or both. Under just what set of conditions in particular cases the fungus is most likely to attack the host, or is certain to do so, are points on which, for the most part, there is not yet enough evidence to decide positively, but as time goes on we may confidently expect to see many of these problems worked out fully, our knowledge of the complex relations of host and parasite being yet only in its infancy.

In this series of notes my desire is simply to put on record certain observations which may contribute toward the solution of a most interesting problem of phytopathology. There is no doubt that mycologists must become closer observers of local weather conditions and of the individual, varietal, and specific peculiarities of plants, if they would satisfactorily explain the behavior of many fungous diseases.

PEACH CURL.*

It is well known that gardeners and fruit-growers have frequently ascribed this disease (mildews, also) to the depressing influence of cold. Mycologists, on the other hand, since the discovery of *Taphrina*, have, perhaps too generally, assumed the direct cause to be the only necessary factor in the production of curl.

The conditions under which peach curl appeared in the orchard of Mrs. W. O. Shallcross, at Locust Grove, Md., in the spring of 1891, are so peculiar and bear so directly on the point at issue that it seems worth while to set them down somewhat fully. This orchard contains about 1,050 trees, now set five years. It is situated on the east side of Chesapeake Bay, on loose, thin upland, in a region of extensive orchards, the nearest being about one-half mile distant. Peach curl due to *Taphrina* is not troublesome in eastern Maryland or Delaware. It was present in quantity for the first time in many orchards in Kent County, in 1890, and was so much more than usually abundant everywhere as to receive notice in this JOURNAL (Vol. VI, p. 107). Probably there was more or less of it in this orchard, but not enough to attract special attention.

* *Taphrina deformans* (Berk.), Tul.

The orchard contains cases of peach yellows, and alternate strips have been under treatment since the autumn of 1889, and consequently the entire orchard has been subject to frequent inspection. The following examinations were made in the spring of 1891:

April 16 every tree was carefully examined in all parts above ground for symptoms of yellows. This was to determine whether any new cases had appeared since fall. The tentative diagnosis of new cases was based principally on the color and state of advancement of the unfolding leaves, and for this reason the inspection of the foliage of each tree was minute. The leaf buds had been open about two weeks, and some varieties were then in blossom. The weather for a week had been dry and pleasant.

April 20 the fertilizers were put on. The foliage was much larger than on the 16th and growing rapidly, influenced by warm weather and a heavy thunderstorm on the night of the 18th. The fertilizer was harrowed in on the 21st, but the orchard was not plowed until May 7. The application of the fertilizers consumed most of the day, during which I passed from row to row through all parts of the orchard seeing every tree. With one exception all the varieties were then done or nearly done blossoming, and the petals were on the ground.

April 23 the orchard was revisited and two strips were limed. Again many of the trees were examined closely. All varieties were done flowering and some forward fruits had begun to burst the "cap."

During these three visits I observed no trace of *Taphrina*. On the last visit the older leaves were 1-2 inches long.

May 1 I revisited the Shallcross orchard, and was surprised to find peach curl on nearly all of the trees. There were thousands of affected leaves, and the curl was the first object to attract attention. The orchard was visited to secure buds for inoculations, but the curl was so abundant that difficulty was experienced in finding cuttings free from it.

This great outbreak of *Taphrina* came upon the trees during the last week in April. The minuteness of the observations on April 16, 20, and 23 fixes the date beyond reasonable dispute. There was no noticeable curl prior to April 23, and the orchard was full of it from one end to the other on May 1.

Prior to the 24th the weather was warm for a whole week, and vegetation was tender and growing very rapidly. Following this and during the week in which the curl developed came a sudden cold wave of three days duration. On Thursday the 23d, the temperature reached a maximum of 80° F. On the 24th it dropped to 54°-64°; on the 25th it was 44°-64°; and on the 26th it was 40°-62°, with a slight frost in low places.* The next day it was warm again, the range being from 50°-80°.

* The minimum records are those of early morning (sunrise), and do not represent the lowest temperature of the twenty-four hours. All were recorded by Dr. W. S. Maxwell, Still Pond, Md.

This coincidence is suggestive, to say the least, and I am inclined to believe that the sudden drop in the temperature had something to do with this sudden and very unusual prevalence of the curl. Probably some other unknown factor also favored the development of the fungus in this particular orchard, *e. g.*, some soil condition. This is the more likely because no other orchard under observation was anywhere near so badly attacked.

PEACH MILDEW.*

This mildew has been found occasionally since 1887, but never upon many trees in any one orchard. It usually attacks the leaves and young stems. On the latter it forms a dense, felt-like, persistent hyphæ-complex which is first white and afterwards a dirty gray, the epidermis being cracked open and destroyed or much injured and a thick brown layer of cork being formed under the mycelial patches. The mildew produces conidia in abundance, but perithecia have not been found, although the search has been continued into winter.

In Maryland and Delaware particular trees are attacked year after year and become stunted, while surrounding ones escape. Often only one or two trees in an orchard will be attacked. This fact has been so noticeable during the last five seasons that it seemed probable the disease was brought from the nursery. Its persistence on certain trees and the freedom of others was only explainable on the hypothesis of some individual peculiarity which I was unable to discover.

This year the mildew was observed in Maryland, Michigan, and Georgia, and in central Michigan it was more than usually prevalent. At Hubbardston it attacked a dozen very thrifty seedlings in the fifth year of growth and apparently for the first time, defoliating the tops of the trees in June and July and causing a new growth of leaves and branches not unlike incipient hexenbesen. In this case the origin of the mildew is unknown, but in case of a Maryland tree known (!) to have mildewed in 1889 and 1890, the fungus was found on the unfolding shoots so early in the spring and to such an extent as to make it almost certain to have wintered over in the form of perennial mycelium. Several hundred leaves and stems were covered with white mycelia and conidial fruits prior to the time of blossoming, and in some cases almost before the buds were open. No perithecia could be found on this tree and no mildew this year or last year on any of the neighboring trees. From other trees fresh looking mycelium has been taken in midwinter, and I have no doubt as to its perennial nature.

Later in the season Mr. J. W. Kerr, of Denton, Md., called my attention to four yearling peach trees which were badly mildewed, although they had been grown from fruits procured by cross fertilization and did not have the same parentage. The most conspicuous point of agreement was the absence of glands at the base of the leaf blade. Mr.

* *Sphaerotheca pannosa* (Wallr.) Lev. (?).

Kerr stated that during a large nursery experience he had observed trees bearing leaves destitute of these large glands to be specially subject to mildew. Other nurserymen have observed the same fact, even as long ago as the days of Downing. This, in connection with the fact that mildew is rare in the eastern United States and that most of our orchard varieties possess glandular leaves, led me to make careful observations during the remainder of the year. The tree above referred to as attacked in early spring bore leaves destitute of glands.* So also the twelve at Hubbardston, Mich. In fact, frequent observations in the orchards of several States brought to light everywhere the same curious correlation. *Trees with gland-bearing leaves were free from mildew, and mildewed trees bore leaves destitute of glands.*

One exception only in perhaps 150 cases was noted; a tree with slight mildew and traces of glands. The same correlation has also been observed, according to Mr. Wickson, in California. It would seem, therefore, as though peach trees of the type bearing glandular leaves are more resistant to this mildew than other varieties, but whether this will hold good for all localities and all varieties remains to be seen.

BLACK SPOT OF PEACHES.†

This disease was unusually prevalent on the Delaware and Chesapeake peninsula. Indeed, I have never before known it to be one-fourth as abundant. All kinds were attacked, even the early and midseason varieties which usually escape. Many fruits were very badly spotted and unsalable. Very often also the spots coalesced into broad patches covering one-third to one-half of the peach. The side attacked was dwarfed. The flesh under the black patches was unusually solid and ripened very slowly, remaining greenish and bitter when the other side was fully ripe.

The observations of this year confirm earlier ones and lead me to think that dry weather is not favorable to the development of this fungus. During the growth and ripening of the fruit, rains occurred at frequent intervals and there was no dry spell such as usually occurs. January, February, March, and the first week in April were also rainy, and the winter was mild; no zero weather.

FROSTY MILDEW.‡

This parasite evidently flourishes best in shady places. It was unusually common on the Chesapeake and Delaware peninsula in the fall of 1891, especially on trees bearing dense and late-ripening foliage. In previous seasons I have also noticed it most abundant on the foliage of highly fertilized trees, especially those given nitrogen or complete fertilizers and growing late into autumn. For example, in the same

* These glands secrete a fluid sought after by bees and other insects.

† *Cladosporium carpophilum*, Thim.

‡ *Cercospora persica*, Sacc.

region in 1890 it was rare on unfertilized trees, but very common on those which received complete fertilizers, especially on the lower and inner leaves. The conidia develop on the under surface of the leaf, often in restricted areas visible above as yellow or yellowish green patches with definite margins. Very late in the season, before the fall of the leaves or afterward, pycnidia develop on the conidial surface and in the body of the leaf in such a manner as to lead one to believe them a part of the cycle of development. These were first observed in 1890 and again in 1891. Other bodies similar to the phoma conceptacles, but destitute of spores, accompany these, and a search toward spring would perhaps reveal the presence of ascospores, and might lead to the determination of the true position of this form-genus.

PEACH RUST.*

Puccinia pruni-spinosae occurs but rarely in this latitude (39°), and then mostly on thickly planted nursery stock. In Georgia it is more abundant, but there also it appears to prefer nurseries to orchards. Last year and this year it did not attack the trees until after June. In a yard at Griffin a number of small seedlings were free from rust the 1st of last July and so badly affected when reëxamined in November that it was almost impossible to find a sound leaf. Most of the leaves bore dozens of sori. The upper surface of the leaf was either a uniform yellowish green or a bright green with sharply defined yellow spots corresponding to the sori on the under surface. As in another locality the preceding year, the leaves nearest to the earth were observed to be most badly attacked. The autumn of 1891 was very dry, the first rain of two months occurring on November 10. At Vineyard, Georgia, in 1890, it was also observed that the fungus spared the parent tree but attacked the foliage growing from buds which were taken from it and set into seedlings in another locality on June 23.

PEACH ROT.†

In eastern Maryland and Delaware it rained every few days during the peach season, and was frequently warm and cloudy between showers. In consequence the brown rot, due to *Monilia*, was very prevalent. The blight of blossoms and twigs has already been described in Vol. VII, pp. 37-38, of this JOURNAL. In some cases as many as twenty blighted blossoms were found on a single twig, but in spite of all accidents the peach crop above the frost line was enormous. The abundance of this fungus in 1891 contrasts strikingly with its rareness in 1890, when there was no fruit, and raises the question how it tided over the year of famine.

* *Puccinia pruni-spinosae*, Pers.

† *Monilia fructigena*, Pers.

PEACH YELLOWS.

This malady has been more than usually prevalent in parts of the eastern United States. There was great complaint of premature fruit in the mountains of western Maryland; on the upper part of the Chesapeake and Delaware peninsula; in portions of Pennsylvania and New Jersey; in Connecticut, and at Fennville, Mich., where they have neglected to remove diseased trees. The disease was also found for the first time at Ann Arbor, Mich. This is a profitable peach region, somewhat isolated from other peach districts of the State. Cases to the number of more than 150 were discovered in midsummer. They were in ten different orchards, and in one or two the evidence indicated that the disease had been present more than one year, probably two or three years. The disease seems to have broken out first in the orchard of J. D. Baldwin, in trees brought from New Jersey. Seventy-five diseased trees were removed from this orchard and forty-five from an adjoining one. All affected trees have been destroyed, and a vigorous effort will be made to prevent the extension of the disease.

Examinations in early spring of trees known to have been healthy the preceding autumn showed that it is possible to diagnose a certain number of cases before the trees blossom, but not all of them. The first symptoms of the disease may appear at any time from early spring to late autumn.

CLUBBED BRANCHES.

Complaints have been received from Michigan and New York of a nursery trouble which renders peach trees unsalable without permanently injuring them. The terminal buds are killed, and side buds push, giving to the top a branched, stunted, clubbed appearance, not unlike that occurring naturally in certain varieties, *e. g.*, of Hinman and Garfield. The injuries appear to be done in May or June, and specimens were received too late in the season to determine the cause. This trouble has been present in both States for at least two years. Whole blocks of trees may be affected. They are said to make good roots and to grow out of the trouble the following season.

In specimens sent in more recently from Ohio many of the secondary branches were much thickened at the base, very spongy, and easily compressed. A microscopic examination showed many dry cavities in the xylem cylinder and an almost complete absence of lignification, the characteristic stains with lignin reagents being confined to the vicinity of the pith and to a few scattered bundles of wood fibers. A large number of trees in the middle of a nursery were seriously injured.

STEM AND ROOT TUMORS.

Irregular, tuberform, rough, warty outgrowths on the stem and roots of the peach at or just beneath the surface of the earth have been unusually common in nursery stock this year. Specimens were collected

in the District of Columbia and middle Georgia, and were received from California and Missouri. Some of these growths were as much as 2 inches in diameter, *i. e.*, much larger than the stem itself. Sorauer reports similar swellings on apple and pear trees, and ascribes them to mechanical injuries.

PEACH ROSETTE.

This disease is on the increase in Georgia, and its contagious nature has been settled beyond dispute.* Root grafts have been made to determine whether the contagion exists in all parts of the tree or only in the top. Cross inoculations have also been made, peach on plum and plum on peach, to determine experimentally whether the peach and the plum rosette are identical. Other experiments are in progress.

PLUM BLIGHT.

This disease (see Vol. VI, p. 108, of this JOURNAL) has done less than the usual amount of damage in Georgia, but there have been some cases.

PEAR DISEASES.

The pear crop on the Delaware and Chesapeake peninsula was enormous and quite free from scab (*Fusicladium*) and the spot disease due to *Entomosporium*. Pear trees were in full bloom at Chestertown and Still Pond, Md., on April 19, and the first scab was found on May 3, when the young fruits were about one-fourth inch in diameter. Two hours search brought to light only twenty-five scabby fruits. During blossoming and immediately after, the weather was dry, and there were two cold waves, April 24-26 and May 4-6. The records of Dr. Maxwell seem to show that pear scab has been abundant whenever there has been a combination of wet weather and high temperature during and immediately following the time of blossoming, and not troublesome in other years. Should additional observations confirm this view, there is in it a hint as to the years when treatments for scab will be most necessary.

The first *Entomosporium* spots were found on the leaves April 21. The damage in Maryland and Delaware in 1891 was confined principally to the leaves. These fell so early that many orchards blossomed and renewed their foliage in late autumn. The leaves of the Kieffer pear were not injured. This variety is noticeably resistant.

With the exception of one orchard, there has been no pear blight† worth mentioning in the vicinity of Still Pond, Md., in five years. The large commercial orchards have been remarkably free from it. These

* Additional Evidence on the Communicability of Peach Yellows and Peach Rosette. Government Printing Office, Washington, D. C., 1891.

† *Bacillus amylovorus* (Burr.) De Toni.

consist principally of Bartlett, Howell, Duchess d'Angoulême, Lawrence, and Kieffer. Choicer varieties blighted badly in years past, and their cultivation was abandoned.

SYCAMORE BLIGHT.*

The Sycamore disease due to *Gloeosporium nervisequum* appeared suddenly at Dover, Del., between May 6 and 14. A special examination of a large tree was made on the first date to discover the blight, because it had appeared on the tree in previous years. Not a trace was found, but having occasion to pass the same tree a week later, dozens of blighted shoots and dead and drooping leaves were found on all parts. Immediately preceding this attack came a cold snap. On the morning of the 4th there was a white frost, on the 5th it was very cold, with a black frost at night, which destroyed the peach crop on flat lands. On the 6th it was still colder with a fall of hailstones. Following this and during the week in which the blight appeared came a hot spell. It was very warm on May 9, 10, and 11.

NEW FUNGOUS DISEASES OF IOWA.

By L. H. PAMMEL.

The following paper treats mostly of new diseases of plants, but reference will also be made to a few that have been the subject of recent papers. Its scope will be limited to such diseases as have been destructive to farming and horticultural interests during the past year in Iowa, since to do justice to the subject over the whole country would take too much time and space.

The subject can naturally be divided as follows:

- I. Fungi affecting forage plants and cereals.
- II. Fungi affecting fruits and fruit trees.
- III. Fungi affecting forest trees.

To the farmer in Iowa the diseases under the first head are of the greatest importance since the wealth of the State depends largely upon successful grain and forage crops.

I.—FORAGE CROPS AND CEREALS.

Diseases of wheat.—Aside from the usually common grain rusts (*Puccinia graminis*, and *P. rubigo-vera*) a serious disease of the wheat has appeared in the so-called "blight," or "scab," as the disease is called in different parts of the country. This disease causes the upper part of the

* *Gloeosporium nervisequum*, (Fckl.) Sacc.